APPLICATION

FOR

UNITED STATES PATENT

Docket: 05045

To all whom it may concern:

Be it known that, John Patrick Quigley and Terry Ludwig

has invented certain new and useful improvements in

Door Latching Device and Method

of which the following is a full, clear and exact description:

DOOR LATCHING DEVICE AND METHOD

FIELD OF THE INVENTION

The present invention relates generally to a device and method for latching a door closed against a door frame.

BACKGROUND OF THE INVENTION

Various arrangements for latching a door closed against a frame are known. Some of these latches are used with gasket-sealed doors that swing from a hinge on one side of the door. A known type of latch employs a power-operated reciprocating latch bar having a cam surface that engages and captures a pin or roller on the door and urges the pin in the closed direction to hold the door closed. The latch bar may be pneumatically operated and the cam surface may be provided on a slot opening in the bar so that as the door swings into a closed position, the pin on the door swings into the slot. In some applications the camming contact of the latch bar and pin may urge the door closed against an opposing force provided by compression of a resilient gasket provided between the door and the door frame.

A disadvantage of this known arrangement is that it requires power operation of the latch bar, adding complexity to the overall device. Accordingly, it would be desirable to have a door latch that can be manually operated.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, an apparatus for latching a door against a frame is provided. The apparatus includes a door pin extending from the door and a handle

lever rotatably mounted to the door and having a handle pin extending therefrom. A latch bar is mounted for reciprocating travel relative to the frame. The latch bar has a first slot having a cam surface adapted to receive the door pin, and a second slot adapted to receive the handle pin. The latch bar and handle have a first position where the handle pin enters the second slot and the door pin enters the first slot, and a second position where the handle pin contacts the second slot and the cam surface bears against the door pin. Rotation of the handle when the latch bar is in the first position causes the handle pin to bear against the second slot, moving the latch bar in a latching direction from the first position to the second position, so that the first slot on the cam surface bears against the door pin and urges the door in a closing direction.

In accordance with another embodiment of the present invention, an apparatus for latching a door against a frame has a first engagement means extending from the door; a second engagement means mounted to the door frame and movable between two positions for engaging with the first engagement means in the second position; and actuating means for actuating the second engagement means between the first and second positions. The actuating means includes a rotating handle having a handle pin extending therefrom that contacts a slot provided in the second engagement means to move the second engagement means from the first to the second positions when the handle is rotated.

In accordance with another embodiment of the present invention, a method for latching a door against a frame includes the steps of inserting a pin mounted to the door into a first slot on a latch bar mounted to the frame; inserting a handle pin mounted to a handle to a second slot on the latch bar; and rotating the handle so that the pin urges the latch bar in a first direction so that the first slot cammingly contacts the first pin to urge the door into a closed position.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described below and which will form the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract included below, are for the purpose of description and should not be regarded as limiting.

As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a door and frame having a latch according to the present invention, shown with the door in a closed and locked position.

FIG. 2 is a perspective view of a door and frame having a latch according to the present

invention, shown with the door in an unlocked and partially open position.

FIG. 3 is a perspective view of a door and frame having a latch according to the present invention, shown with the door in an unlocked and more fully open position than in FIG. 2.

FIG. 4 is a side view of a door and frame showing the door closed and the latch in an unlocked position.

FIG. 5 is a side view of a door and frame showing the door closed and the latch in a partially locked position.

FIG. 6 is a side view of a door and frame showing the door closed and the latch in a fully locked position.

FIG. 7 is a graph showing an example of a relationship between gasket resisting force and gasket compression.

FIG. 8 is a graph showing an example of a relationship between gasket compression, gasket resisting force and degree of handle rotation.

FIG. 9 is a graph showing an example of a relationship between handle rotation and torque applied to the handle.

FIG. 10 is a graph showing an example of a relationship between latch bar force, handle torque and degree of handle rotation.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a device and method for latching a door 2 closed against a frame 4. Referring generally to FIGS. 1-6, in a preferred embodiment, the latch device 10 includes

a movable latch bar 12. The latch bar 12 has a first slot 14 with a cam surface 16 that contacts a door pin 18, or other suitable engaging element, that projects from the edge of the door 2 opposite the door hinge 20. The door 2 has a hinge 20 on one side, and the door pin 16 extends outwardly from the side of the door 2 on the opposite side from the hinge 20. One or more door pints 18 and corresponding first slots 14 may be employed, depending on, for example, the door size and the load on the door.

The latch bar 12 is preferably mounted on the frame of the door 2 generally adjacent the edge of the door that has the door pin 18, and the latch bar 12 may reciprocate in a vertical direction between locked and unlocked positions. Referring to FIG. 4, the latch bar 12 has a first slot 14 with a cam surface 16 so that when the latch bar 12 is in an unlocked position, the door pin 18 is unobstructed and the door 2 is therefore free to swing between open and closed positions with the door pin 18 free to enter and exit the first slot 14. Referring to FIG. 5, when the door 2 is closed, or nearly closed, the door pin 18 enters the first slot 14, and movement of the latch bar 12 in a latching direction A will cause the cam surface 16 to contact the door pin 18 and urge the door pin 18 in the direction B towards a more fully closed position. In some embodiments, the door 2 may have a gasket 22 between the door 2 and frame 4. The latch bar movement in direction A causes a door closing force in direction B that compresses the gasket 24.

In a preferred embodiment, the latch bar 12 is reciprocated by actuation of a manually operable assembly. A preferred latch operating assembly includes a second slot 24 provided on the latch bar 12. The second slot 24 is preferably oriented substantially perpendicular to the direction of movement of the latch bar 12. A rotating handle lever 26 is pivotally mounted to the edge of the

door 2 opposite to the hinged side of the door. The rotating handle lever 26 rotates about a handle axis and has a handle 28 and one end and a handle pin 30 at its other end.

As shown in FIG. 4, once the door 2 is in a partially closed position, the handle pin 30 will enter the second slot 24 and the door pin 18 enters the first slot 14. At this point the handle is rotated in a downward direction C as shown in FIG. 5 so that the handle pin 30 urges the second slot 24 upwardly in the latch closing direction A, camming the door pin 18 in the closing direction B.

As discussed in more detail below, in a preferred embodiment, rotation of the handle causes the latch bar 12 to move past a top dead center position into a locked position shown in FIG. 6. In this way, rotation of the handle lever 26 urges the latch bar 12 in the closing and locking direction A so that the cam surface 16 on the first slot 14 urges the door pin 18 in the closing direction B so as to fully close the door 2 against the frame 4, compressing any intermediate gasket 22 that may be present.

In a preferred embodiment, the axis of the handle lever 26 and the positions of the handle pin 30 and the second slot 24 are arranged so that rotation of the handle lever 26 in the latching direction C occurs through a first range of rotation R1 at which the torque on the handle increases as the door is urged closed, as shown in FIG. 8. The handle 34 then reaches a "top dead center" point of maximum compressive force ~~and maximum torque~~ at which the door 2 is urged shut with a predetermined force. This "top dead center" point is represented by the vertical line in FIGS. 8-10 and occurs in between the positions shown in FIGS. 5 and 6.

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The invention can be suitable for doors with a gasket 22 having a springback resisting force that increases with gasket compression, in a relationship such as shown in FIG. 7. The gasket 22 may be affixed to a surface of the door 2 so that it is compressed against the frame 4 when the door

2 is closed. In embodiments with such a gasket 22, the door will be therefore compressing the gasket with a predetermined degree of force at the "top dead center" point, because the spacing between the door and frame occupied by the gasket will have a predetermined value.

As shown in FIG. 9, in operation to latch the door, the handle 26 is rotated in direction C in a predetermined range of rotation R2 past the "top dead center" location, which actually permits some movement of the latch bar in the unlatching direction D. The handle 26 is prevented by a stop from further rotation in direction C, so that this past-center (or over-center) movement causes the reaction force in the latch (resulting from the compression of the gasket, or simply from compressive forces between the door and frame where no gasket is present) to tend to hold the latch in the closed, latched position.

FIGS. 9 and 10 show that the maximum handle torque occurs in this embodiment approximately 14 degrees before reaching top dead center. The latch bar force is greatest at top dead center as show in FIG. 10.

To unlatch the door, a force is required to be applied against this over-center force in order to rotate the latch in the unlatching direction E past the "top dead center" point C. Therefore, the door tends to remain closed and latched until a user applies sufficient pressure in the unlatching direction E to move past top dead center. Once that point is passed, the gasket force will push the door open.

In a preferred embodiment, the latch bar 12 may be biased by gravity or by a spring or other suitable biasing device into the unlocked position, so that when the door is open, the latch bar remains in the unlocked position, available to receive the latch pin 16 and the door handle pin 36 as

the door swings closed. The handle lever 32 can be similarly biased into a position corresponding to the unlocked position. The handle pin 36 will align with and engage the second slot 30, as the door swings closed.

In the preferred embodiment, the latch bar 12 is shown mounted to the door frame on the side opposite of the hinge 20. Two door pins 18 are used along with two first slots 14. Depending upon variables such as the size of the door, the load on the door, and the degree of gasket compression desired, the number of door pins 36 and corresponding cam slot openings 34 may be varied to provide the desired latching force. Also, the latch bar is illustrated having reciprocal motion relative to the door frame via guide slots in the latch bar and guide pins 36 attached to the door frame. Other suitable methods of supporting the latch bar for reciprocal movement may be used.

The invention may be used with doors on a wide variety of devices, including ovens, microwave ovens, refrigerators or other devices.

The many features and advantages of the invention are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the invention which fall within the true spirits and scope of the invention. Further, since numerous modifications and variations will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed is: